

## Gas Network Noncooperative Game

**Authors :** Teresa Azevedo PerdicóLis, Paulo Lopes Dos Santos

**Abstract :** The conceptualisation of the problem of network optimisation as a noncooperative game sets up a holistic interactive approach that brings together different network features (e.g., compressor stations, sources, and pipelines, in the gas context) where the optimisation objectives are different, and a single optimisation procedure becomes possible without having to feed results from diverse software packages into each other. A mathematical model of this type, where independent entities take action, offers the ideal modularity and subsequent problem decomposition in view to design a decentralised algorithm to optimise the operation and management of the network. In a game framework, compressor stations and sources are understood as players which communicate through network connectivity constraints-the pipeline model. That is, in a scheme similar to 'tatonnement', the players appoint their best settings and then interact to check for network feasibility. The devolved degree of network unfeasibility informs the players about the 'quality' of their settings, and this two-phase iterative scheme is repeated until a global optimum is obtained. Due to network transients, its optimisation needs to be assessed at different points of the control interval. For this reason, the proposed approach to optimisation has two stages: (i) the first stage computes along the period of optimisation in order to fulfil the requirement just mentioned; (ii) the second stage is initialised with the solution found by the problem computed at the first stage, and computes in the end of the period of optimisation to rectify the solution found at the first stage. The liability of the proposed scheme is proven correct on an abstract prototype and three example networks.

**Keywords :** connectivity matrix, gas network optimisation, large-scale, noncooperative game, system decomposition

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